CURRICULUM VITAE

MARY C. BROCK

(publishes as MARY C. BARTH)

EDUCATION:

1991	Ph.D. Atmospheric Sciences	University of Washington
1985	B.S. Chemical Engineering	University of Colorado

EMPLOYMENT:

2004–present	Scientist III
2000–2004	Scientist II
1996–2000	Scientist I
1994–1996	Associate Scientist III
1991–1994	Visiting Postdoctoral Scientist Mesoscale and Microscale Meteorology / Atmospheric Chemistry Divisions National Center for Atmospheric Research, Boulder, Colorado.
1985–1991	Graduate Research Assistant Cloud and Aerosol Research Group, Department of Atmospheric Sciences University of Washington, Seattle, Washington.
1984–1985	Undergraduate Research Assistant Laboratory for Atmospheric and Space Physics, University of Colorado Boulder, Colorado.

RESEARCH INTERESTS:

Dr. Barth's research focuses on how clouds affect atmospheric chemistry and on how chemistry can affect cloud properties. This research is done using numerical models for different spatial scales.

Most of her recent research has focused on thunderstorms and chemistry. Dr. Barth is conducting numerical simulations with the Weather Research and Forecasting model coupled with gas and aqueous-phase chemistry to elucidate the processes that control the distribution of chemical species in thunderstorms. Further, she is a Principal Investigator of the Deep Convective Clouds and Chemistry (DC3, http://utls.tiimes.ucar.edu/science/dc3.html) field experiment that seeks to characterize the effect of midlatitude, continental convection on the transport and transformation of atmospheric constituents.

Dr. Barth is also examining the influence of boundary layer processes on chemical reaction rates. To do this, Dr. Barth has coupled lumped hydrocarbon chemistry with a large eddy simulation. These studies have been extended to cloud-topped boundary layers so that effects of buoyancy, of aqueous chemistry, and of scattering of solar radiation on chemical species redistribution can be assessed.

AWARDS and HONORS

2007	AGU Editor's Citation for Excellence in Refereeing for Journal of Geophysical Research
2003	NCAR Special Recognition Award

SCIENTIFIC SERVICE ACTIVITIES:

Professional Service

2007–2008	Co-chair of the International Programme Committee for the 10th International Global Atmospheric Chemistry Conference
2006–2008	Secretary of the AGU Atmospheric Sciences Section (Atmos. Chem.)
2006–present	Member of the ARM Climate Research User Facility Science Board
2004–2007	Member of the NSF Observing Facilities Advisory Panel (OFAP)
2004–2007	Leader of the cloud chemistry case studies intercomparison at the 6th International Cloud Modeling Workshop (July 12–16, 2004).
2000–2008	Member of International Commission on Clouds and Precipitation.
1999–2001	Co-leader of the cloud chemistry case studies intercomparison at the 5th International Cloud Modeling Workshop (August 7–11, 2000).
2003	Member of organizing committee for NCAR/UCAR Junior Faculty Forum, on Future Scientific Directions (June 18–20, 2003).
1999–2000	Member of organizing committee for Modeling Chemistry in Cloud and Mesoscale Models, (March 6–8, 2000).
1998–1999	Member of organizing committee for GTP workshop, Mixing and Reactive Turbulence Workshop (July 13–16, 1999).
1997–1998	Member of organizing committee for GTP workshop, Observations, Experiments, and LES: A Triad for Geophysical Turbulence Studies (August 13–15, 1998).
1988–present	Member of the American Meteorological Society.
1988–present	Member of the American Geophysical Union.

Invited Talks

Oct. 2007	*Relevance of- and challenges in the representation of surface and boundary layer processes in mesoscale chemistry transport models* Expert Workshop on the Relevance of Surface and Boundary Layer Processes for the Exchanges of Reactive- and Greenhouse Gases, Wageningen, Netherlands
Dec. 2006	*Processing of Chemical Constituents by Deep Convection* AGU Fall Meeting, San Francisco, CA
Oct. 2006	*Convective-Scale Cloud Chemistry Simulations of a Thunderstorm*, NOAA/ESRL, Chemical Sciences Division Seminar
Oct. 2006	*Convective-Scale Cloud Chemistry Simulations of a Thunderstorm*, Colorado State University, Atmospheric Sciences Colloquium
Mar. 2006	*Cloud Chemistry Simulations of a Thunderstorm*, University of ,

	South Florida, Environmental Research Interdisciplinary Colloquium
Feb. 2006	*Cloud Chemistry Simulations of a Thunderstorm*, Harvard University, Atmospheric Sciences Seminar
Dec. 2004	*Simulating the Redistribution of Formaldehyde in Deep Convection Using the Weather Research Forecast Model Coupled with Aqueous Chemistry*, AGU Fall Meeting, San Francisco, CA
Feb. 2003	*Cloud Processing: What are the links with climate and how well are we modeling them?* Chemistry Climate Interactions Workshop, Santa Fe, NM
Nov. 2002	*Relative Importance of Cloud Chemistry in Deep Convection* University of Wyoming, Dept. of Atmospheric Sciences seminar
Aug. 2002	*Effect of Cloud Chemistry on Boundary Layer Chemistry* Telluride Atmospheric Chemistry Workshop
Jul. 2002	*How Aqueous Chemistry Affects Sulfate Aerosols* ASP Summer Colloquium/NCAR
Jul. 2002	*The Relative Importance of Aqueous Chemistry to the Global Sulfur Cycle*, ASP Summer Colloquium/NCAR
Feb. 2001	*Large Eddy Simulations of Isoprene Chemistry in the Convective Boundary Layer*, NOAA Aeronomy Laboratory seminar
Sep. 1998	*Clouds and Chemistry, Chemistry and Clouds* ASP/NCAR
Jun. 1996	University of Utah
Mar. 1996	Colorado State University

NCAR/UCAR Service

2003–2004	Member of MMM Director Search Committee
2003	Leadership Academy participant
2002–2003	Leader of the MMM CaSSP project
2001–2004	Member of UCAR Distinguished Achievement and Outstanding Accomplishments Awards Jury. (Chair, 2002)
2000–2005	Member of the University Relations Committee.
2000–2002	Leader of the Early Career Scientists Assembly.
1997–present	Member of the Geophysical Turbulence Program, NCAR.
1997–present	Member of the NCAR Aerosol Program, NCAR.

Education and Outreach

2008	Scientific mentor with the SOARS summer program.
2007	Member of the GLOBE Learning Expedition Student Research Competition Review Committee.
1999–2002	Member of thesis committee for Amy Stuart (Stanford University).
1998–2000	Member of thesis committee for Rawlings Miller (Univ. of Arizona).
2003, 2005	Scientific mentor with the SOARS summer program.
2002	Writing mentor with the SOARS summer program.
1997-2001	Scientific mentor with the SOARS summer program.

1997-1998 PROJECT LEARN teacher and intern leader.

PUBLICATIONS – Ph.D. Dissertation

Date	Advisor	Title
1991	Dr. Dean Hegg	Numerical Modeling of cloud chemistry and acid deposition associated with the interactions of two rainbands and some comparisons with observations

PUBLICATIONS – Refereed

34. Barthe, C., W. Deierling, and **M. C. Barth**, 2008: The estimation of total lightning from various thundercloud parameters: A cloud-resolving model study. Submitted to *J. Atmos. Sci.*.

33. Kim, D., C. Wang, A. Ekman, **M. C. Barth**, and P. Rasch, 2008: Distribution and direct radiative forcing of carbonaceous and sulfate aerosols in an interactive size-resolving aerosol-climate model. *J. Geophys. Res.*, **113**, D16309, doi:10.1029/2007JD009756.

32. Barthe, C., **M. C. Barth**, 2008: Evaluation of a new lightning-produced NOx parameterization for cloud resolving models and its associated uncertainties. *Atmos. Chem. Phys.*, **8**, 4691-4710.

31. Kim, S-W, C-H Moeng, J. C. Weil, and **M. C. Barth**, 2007: Comment on "Fumigation of pollutants in and above the entrainment zone into a growing convective boundary layer: A large-eddy simulation". *Atmos. Environ.*, **41**, 7679-7682.

30. **Barth, M. C.**, S.-W. Kim, C. Wang, K. Pickering, L. Ott, G. Stenchikov, M. Leriche, S. Cautenet, J.-P. Pinty, Ch. Barthe, C. Mari, J. Helsdon, R. Farley, A. Fridlind, A. Ackerman, V. Spiridonov, B. Tosko, 2007: Cloud-scale model intercomparison of chemical constituent transport in deep convection. *Atmos. Chem. Phys.*, **7**, 4709-4731.

29. **Barth, M. C.**, S-W Kim, W. C. Skamarock, A. L. Stuart, K. E. Pickering, L. E. Ott, 2007: Simulations of the redistribution of formaldehyde, formic acid, and peroxides in the July 10, 1996 STERAO deep convection storm. *J. Geophys. Res.*, **112**, D13310, doi:10.1029/2006JD008046.

28. **Barth, M. C.**, 2006: The importance of cloud drop representation on cloud photochemistry. *Atmos. Res.*, **82**, 294-309.

27. Kazil, J., Lovejoy, E. R., **Barth, M. C.**, O'Brien, K., 2006: Aerosol nucleation over oceans and the role of galactic cosmic rays, *Atmos. Chem. Phys.*, **6**, 4905-4924.

26. **Barth, M.**, J. McFadden, J. Sun, C. Wiedinmyer, P. Chuang, D. Collins, R. Griffin, M. Hannigan, T. Karl, S-W Kim, S. Lasher-Trapp, S. Levis, M. Litvak, N. Mahowald, K. Moore, S. Nandi, E. Nemitz, A. Nenes, M. Potosnak, T. Raymond, J. Smith, C. Still, C. Stroud, Coupling between land ecosystems and the atmospheric hydrologic cycle through biogenic aerosol pathways, *Bull. Amer. Meteor. Soc.*, **86**, 1738-1742, 2005.

25. Vila-Guerau de Arellano, J., S-W Kim, **M. C. Barth**, and E. G. Patton, 2005: Transport and chemical transformations influenced by shallow cumulus over land, *Atmos. Chem. Phys.*, **5**, 3219-3231.

24. Kim, S-W, C-H Moeng, J. C. Weil, and **M. C. Barth**, 2005: Lagrangian particle dispersion modeling of fumigation process using large-eddy simulation, *J. Atmos. Sci.*, **62**, 1932-1946.

23. Liu, C-H, D. Y. C. Leung and **M. C. Barth**, 2005: On the prediction of air and pollutant exchange rates in street canyons of different aspect ratios using large-eddy simulation, *Atmos. Environ.*, **39**, 1567-1574.

22. Liu, C-H, **M. C. Barth**, and D. Y. C. Leung, 2004: Large-eddy simulation of flow and pollutant transport in street canyons of different building height to street width ratios, *J. Appl. Meteorol.*, **43**, 1410-1424.

21. **Barth, M. C.**, S. Sillman, R. Hudman, M. Z. Jacobson, C.-H. Kim, A. Monod, and J. Liang, 2003: Summary of the cloud chemistry modeling intercomparison: Photochemical box model simulation, *J. Geophys. Res.*, 108(D7), 4214, doi:10.1029/2002JD002673.

20. Skamarock, W. C., J. E. Dye, E. Defer, **M. C. Barth**, J. L. Stith, B. A. Ridley, and K. Baumann, 2003: Observational- and Modeling-Based budget of lightning-produced NOx in a continental thunderstorm, *J. Geophys. Res.*, 108(D10), 4305, doi10.1029/2002JD002163.

19. **Barth, M. C.**, P. G. Hess, and S. Madronich, 2002: Effect of marine boundary layer clouds on tropospheric chemistry as analyzed in a regional chemistry transport model, *J. Geophys. Res.*, **107**, (D11), 4126, doi:10.1029/2001JD000468.

18. Liu, C-H and **M. C. Barth**, 2002: Large-eddy simulation of flow and scalar transport in a modeled street canyon, *J. Appl. Meteorol.*, **41**, 660-673.

17. Brasseur A.-L., R. Ramaroson, A. Delannoy, W. Skamarock, **M. Barth**, 2002: Three-dimensional calculation of photolysis frequencies in the presence of clouds, *J. Atmos. Chem.*, **41**, 211-237.

16. **Barth, M. C.**, A. L. Stuart, and W. C. Skamarock, 2001: Numerical simulations of the July 10 Stratospheric-Tropospheric Experiment: Radiation, Aerosols and Ozone/Deep Convection storm: Redistribution of soluble tracers, *J. Geophys. Res.*, **106**, 12,381-12,400.

15. Patton, E. G., K. J. Davis, **M. C. Barth**, and P. P. Sullivan, 2001: Decaying scalars emitted by a forest canopy: A numerical study, Boundary Layer Meteorology, **100**, 91-129.

14. Hess, P. G., S. Flocke, J-F Lamarque, **M. C. Barth**, and S. Madronich, 2000: Episodic Modeling of the Chemical Structure of the Troposphere as Revealed during the Spring MLOPEX Intensive, *J. Geophys. Res.*, **105**, 26,809-26,839.

13. Skamarock, W. C., J. Powers, **M. C. Barth**, J. E. Dye, T. Matejka, D. Bartels, K. Baumann, J. Stith, D. D. Parrish, and G. Hubler, 2000: Numerical simulations of the 10 July STERAO/Deep Convection Experiment Convective System: Kinematics and transport, *J. Geophys. Res.*, **105**, 19,973–19,990.

12. Dye, J. E., B. A. Ridley, K. Baumann, W. C. Skamarock, **M. C. Barth**, M. Venticinque, E. Defer, P. Blanchet, C. Thery, P. Laroche, G. Hubler, D. D. Parrish, T. Ryerson, M. Trainer, G. Frost, J. S. Holloway, F. C. Fehsenfeld, A. Tuck, T. Matejka, D. Bartels, S. A. Rutledge, T. Lang, J. Stith, R. Zerr, 2000: An Overview of the STERAO–Deep Convection Experiment with Results for the 10 July Storm, *J. Geophys. Res.*, **105**, 10,023-10,045.

11. Kiehl, J. T., T. L. Schneider, P. J. Rasch, **M. C. Barth**, and J. Wong, 2000: Radiative forcing due to sulfate aerosols from simulations with the National Center for Atmospheric Research Community Climate Model (CCM3), *J. Geophys. Res.*, **105**, 1441-1457.

10. **Barth, M. C.**, P. J. Rasch, J. T. Kiehl, C. M. Benkovitz, and S. E. Schwartz, 2000: Sulfur chemistry in the National Center for Atmospheric Research Community Climate Model: Description, evaluation, features and sensitivity to aqueous chemistry, *J. Geophys. Res.*, **105**, 1387-1415.

9. Rasch, P. J., **M. C. Barth**, J. T. Kiehl, S. E. Schwartz, and C. M. Benkovitz, 2000: A description of the global sulfur cycle and its controlling processes in the National Center for Atmospheric Research Community Climate Model Version 3, *J. Geophys. Res.*, **105**, 1367-1385.

8. **Barth, M. C.** and A. T. Church, 1999: The regional and global distributions and lifetimes of sulfate aerosols from Mexico City and southeast China, *J. Geophys. Res.*, **104**, 30,231-30,239.

7. Kreidenweis, S., G. Tyndall, **M. Barth**, F. Dentener, J. Lelieveld, and M. Mozurkewich, Chapter 4: Aerosols and Clouds, in **Atmospheric Chemistry and Global Change**, *eds.* Brasseur, G. P., J. J. Orlando, and G. S Tyndall, 133-179, 1999.

6. **Barth, M. C.** and D. B. Parsons, 1996: Microphysical processes associated with intense frontal rainbands and the effect of evaporation and melting on frontal dynamics, *J. Atmos. Sci.*, **53**, 1569-1586.

5. Yuen, P-F., D. A. Hegg, T. V. Larson and **M. C. Barth**, 1996: Parameterization of heterogeneous droplet chemistry for use in bulk cloud models, *J. Appl. Meteor.*, **35**, 679-689.

4. **Barth, M. C.**, 1994: Numerical modeling of sulfur and nitrogen chemistry in a narrow cold-frontal rainband: The impact of meteorological and chemical parameters., *J. Appl. Meteor.*, **33**, 855-868.

3. **Barth, M. C.**, D. A. Hegg and P. V. Hobbs, 1992: Numerical modeling of cloud and precipitation chemistry associated with two rainbands and some comparisons with observations. *J. Geophys. Res.*, **97**, 5825-5845.

2. Hegg, D. A., S. A. Rutledge, P. V. Hobbs, **M. C. Barth** and O. Hertzman, 1989: The chemistry of a mesoscale rainband. *Quart. J. Royal Meteor. Soc.*, **115**, 867–886.

1. **Barth, M. C.**, D. A. Hegg, P. V. Hobbs, J. G. Walega, G. L. Kok, B. G. Heikes, and A. L. Lazrus, 1989: Measurements of atmospheric gas-phase and aqueous-phase hydrogen peroxide concentrations in winter on the east coast of the United States, *Tellus*, **41B**, 61-69.

PUBLICATIONS — Non-refereed Papers

27. Petch, J., McFarlane, N., Pendlebury, D., Barth, M. and Birner, T., 2007: Modelling of Deep Convection and Chemistry in the Tropical Tropopause Layer: Outcomes from the SPARC-GEWEX-IGAC Workshop, GEWEX Newsletter, August 2007, 10-11.

26. **Barth, M. C.**, S.-W. Kim, C. Wang, K. Pickering, L. Ott, G. Stenchikov, M. Leriche, S. Cautenet, J.-P. Pinty, Ch. Barthe, C. Mari, J. Helsdon, R. Farley, A. Fridlind, A. Ackerman, V. Spiridonov, B. Tosko, 2007: Cloud-scale model intercomparison of chemical constituent transport in deep convection. *Atmos. Chem. Phys. Disc.*, **7**, 8035-8085.

25. **Barth, M.**, T. Birner, N. McFarlane, D. Pendlebury, J. Petch, 2007: Modelling of Deep Convection and Chemistry and their Roles in the Tropical Tropopause Layer: SPARC-GEWEX/ GCSS-IGAC Workshop, June 12-15, 2006, Victoria, BC, Canada, SPARC Newsletter, 7-12.

24. **Barth, M.**, T. Birner, N. McFarlane, D. Pendlebury, J. Petch, 2006: Modeling of Deep Convection and of Chemistry and their Roles in the Tropical Tropopause Layer: SPARC-GEWEX/GCSS-IGAC Workshop: Victoria, BC, Canada, June 12-15, 2006, IGACtivities Newsletter, 31-37.

23. Leriche, M. S. Cautenet, **M. Barth**, N. Chaumerliac, 2007: Modeling of the July 10 STERAO storm with the RAMS model: Chemical species redistribution including gas phase and aqueous phase chemistry, In Air Pollution Modeling and its Application XVIII, edited by C. Borrego and E. Renner, pp. 437-446, Elsevier, Amsterdam, The Netherlands.

22. Vila-Guerau de Arellano, J., S-W Kim, **M. C. Barth**, E. G. Patton, 2006: Transport and chemical transformations influenced by shallow cumulus over land, in preprints of17th Symposium on Boundary Layers and Turbulence, San Diego, California, 21-25 May 2006. http://ams.confex.com/ams/BLTAgFBioA/techprogram/programexpanded_351.htm

21. Acuff, K. and **M. Barth**, Chemical species redistribution by deep convection and its sensitivity to different types of storms, in proceedings of the 7th WRF Users Workshop, Boulder, Colorado, 19-22 June 2006.
http://www.mmm.ucar.edu/wrf/users/workshops/WS2006/WorkshopPapers.htm

20. **Barth, M. C.**, The role of adsorption of chemical species onto ice and snow in deep convection, in proceedings from the 12th Conference on Cloud Physics, Madison, WI, 10-14 July 2006.
http://ams.confex.com/ams/Madison2006/techprogram/programexpanded_346.htm

19. **Barth, M.**, McFadden, J., Sun, J., Wiedinmyer, C., Chuang, P., Collins, D., Griffin, R., Hannigan, M., Karl, T., Kim, S.-W., Lasher-Trapp, S., Levis, S., Litvak, M., Mahowald, N., Moore, K., Nandi, S., Nenes, A., Potosnak, M., Raymond, T.M., Smith, J.N., Stroud, C., and C. Still. 'UCAR/NCAR Junior Faculty Forum on Future Scientific Directions'. NCAR technical note, NCAR TN-467+PROC, 2005.

18. Kim, S.-W., **M. C. Barth**, C.-H. Moeng, The effect of shallow cumulus convection on the segregation of chemical reactants, in Proceedings of the 16th Symposium on Boundary Layers and Turbulence, August 9-13, 2004.

17. Kim, S.-W., C.-H. Moeng, J. C. Weil, **M. C. Barth**, Lagrangian particle dispersion modeling of the fumigation process using large-eddy simulation, in Proceedings of the 16th Symposium on Boundary Layers and Turbulence, August 9-13, 2004.

16. Kim, S.-W., **M. C. Barth**, W. C. Skamarock, WRF model simulations of aqueous chemistry in the July 10 STERAO deep convective storm, in Proceedings of the WRF/MM5 User's Workshop, June 22-25, 2004.

15. **Barth, M. C.**, S.-W. Kim, W. C. Skamarock, Simulating aqueous chemistry in the July 10 STERAO deep convective storm using WRF model, in Proceedings of the 2nd International Workshop on Next Generation NWP Model, May 17-18, 2004.

14. **Barth, M. C.**, R. Cancel, K. Ross, S.-W. Kim, The importance of cloud drop representation on cloud photochemistry, in Proceedings of the 14th International Conference on Clouds and Precipitation, July 19-23, 2004.

13. **Barth, M. C.**, Relative importance of the production and destruction of chemically reactive species in deep convection, in Proceedings of the 14th AMS Conference on Cloud Physics, Ogden, UT, June 3-7, 2002.

12. Liu, C-H, **M. C. Barth**, and S. Madronich, Large-eddy simulation of flow and scalar dispersion inside a street canyon, in Proceedings of the 12th Joint Conference on the Applications of Air Pollution Meteorology with the Air and Waste Management Association, May 20-24, 2002.

11. **Barth, M.**, Modeling the effects of clouds on chemical constituents, contribution to the IGAC newsletter, Issue 23, April 2001, 13-15.

10. Patton, E. G., **M. C. Barth**, K. J. Davis, and P. P. Sullivan: The Interactions Between Turbulence and Photochemistry in the Planetary Boundary Layer, Air and Waste Management Association International Symposium on the Measurement of Toxic and Other Related Air Pollutants, September 12-14, 2000, Research Triangle Park, NC, 2000. (cdrom)

9. **Barth, M. C.**, W. C. Skamarock, and A. L. Stuart, The influence of cloud processes on the distribution of chemical species for the 10 July 1996 STERAO/Deep Convection Storm, in International Conference on Clouds and Precipitation Proceedings, Reno, Nevada, USA, 14-18 August 2000, 960–963.

8. Patton, E. G., K. J. Davis, **M. C. Barth**, and C.-H. Moeng, Large-eddy simulation of convective boundary layer mixing of decaying scalars emitted by a forest canopy, 13th Symposium on Boundary Layers and Turbulence, Dallas, Texas, USA, 10-15 January 1999,

7. **Barth, M. C.**, and P. Hess, Effect of aqueous chemistry in a regional chemistry transport model, Conference on Cloud Physics, Everett, Washington, USA, 17-21 August 1998, 197–200.

6. **Barth, M. C.** and W. W. Grabowski, Preliminary results of cloud effects on the photochemistry in and around stratocumulus, in Report of the Fourth International Cloud Modelling Workshop, WMP Report 29, 83-87, 1998.

5. **Barth, M. C.**, P. Rasch, and J. Kiehl, Sulfur chemistry in the NCAR community climate model, International Conference on Clouds and Precipitation, Zurich, Switzerland, 19-23 August 1996, 1181-1183.

4. **Barth, M. C.**, P. Hess, and S. Madronich, The accuracy of approximate numerical solver techniques in solving the gas-aqueous chemical system, International Conference on Clouds and Precipitation, Zurich, Switzerland, 19-23 August 1996, 1062-1065.

3. **Barth, M. C.** and D. B. Parsons, Microphysical processes associated with intense frontal

rainbands and the impact of evaporation and melting on frontal dynamics, Cloud Physics Conference, 75th Annual Meeting American Meteorological Society, Dallas, Texas, 15 - 20 January 1995, 226-230.

2. **Barth, M. C.**, Evolution of chemical transformations in convection that has a trailing stratiform region, Conference on Atmospheric Chemistry, American Meteorological Society, Anaheim, California, 17 - 22 January 1993, 49-52.

1. **Barth, M. C.**, Hegg, D. A., and P. V. Hobbs, Numerical modeling of cloud chemistry and acid deposition associated with the interactions of two rainbands and some comparisons with observations, Final Report to the Electric Power Research Institute under Research Agreement RP1630-45, June 1991.